NON-PUBLIC?: N
ACCESSION #: 9310010127
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Surry Power Station, Unit 2 PAGE: 1 OF 6

DOCKET NUMBER: 05000281

TITLE: Reactor Trip Due to Partial Actuation of Safety Injection
Master Relay During Logic Testing
EVENT DATE: 08/27/93 LER #: 93-005-00 REPORT DATE: 09/27/93

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 97

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: M. R. Kansler, Station Manager TELEPHONE: (804) 357-3184

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: JC COMPONENT: RLY MANUFACTURER: W121
REPORTABLE NPRDS: YES

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On August 27, 1993 at 1741 hours, with Unit 1 at Cold Shutdown, a Unit 2 automatic reactor trip occurred when both reactor trip breakers opened simultaneously. This Reactor Protection System (RPS) actuation occurred when train B safety injection master relay SIA-B partially actuated unexpectedly during monthly safeguards actuation logic functional testing. Only one of the four sets of contacts on the master relay made-up. This partial actuation resulted in a reactor trip signal which de-energized each reactor trip breakers' undervoltage trip coil. Both reactor trip breakers opened as designed. Proper procedure implementation and operator action stabilized the Unit at the Hot Shutdown condition. The Unit was subsequently brought to Cold Shutdown. The relay was replaced and tested. A Root Cause Evaluation (RCE), including additional testing, was conducted. The evaluation determined that the event resulted from relay chatter and low relay actuation and reset voltages. However, field tests could not identify a source of the

voltage for the observed chatter. RCE recommendations to monitor testing for voltage sources and cover test connection jacks are being implemented. The health and safety of the public were not affected. This report is required by 10CFR50.73 (a)(2)(iv) for a Reactor Protection System actuation.

END OF ABSTRACT

1.0 DESCRIPTION OF THE EVENT

On August 27, 1993 at 1741 hours, with Unit 1 at Cold Shutdown, a Unit 2 automatic reactor trip occurred from 97% reactor power when both reactor trip breakers EIIS: JC, BKR! opened. The First Out indication in the main control room indicated "Reactor Trip Breakers Open". Emergency Operating Procedure 2-E-0, Reactor Trip or Safety Injection, was initiated.

The control rods EIIS: JD, ROD! properly inserted. Control rod M-10 Individual Rod Position Indicator (IRPI) EIIS: JD, ZI! did not indicate full insertion. The turbine trip EIIS: TA, TRB! and generator trip EIIS: TB, TG! actuated upon reactor trip as designed. The Anticipated Transient Without SCRAM Mitigation System Actuation Circuitry (AMSAC) initiated as designed. The Auxiliary Feedwater System EIIS: BA! actuated automatically as expected when steam generator level decreased to the low-low level actuation setpoint due to the resultant inventory shrink following the turbine trip. The main steam dump valves EIIS: SB, V! automatically opened, controlling the Reactor Coolant System (RCS) EIIS: AB! cool down by admitting steam to the main condenser EIIS: SG, COND!. RCS average temperature (Tave) was reduced to 547 degrees F., and the main steam dump valves closed as designed. A slow RCS cool down continued to 530 degrees F. Adequate reactivity shutdown margin existed for this RCS condition and was confirmed by shutdown margin calculation. The Shift Technical Advisor monitored and confirmed stable plant conditions using the Critical Safety Function Status Trees.

At the time of the event, Instrument Technicians were working in train B safety injection logic cabinet EIIS: JE, CAB!, performing monthly testing procedure 2-IPT-FT-RP-S1-001B, Train B Safeguards Actuation Logic Functional Test. The Instrument Technicians had seen and heard safety injection master relay SIA-B EIIS: JE, RLY! chatter unexpec
edly. The master relay chattering generated a

momentary signal which resulted in both reactor trip breakers opening simultaneously. No other safety injection actuations occurred or were required.

The operating team transitioned through Emergency Procedure 2-ES-0.1, Reactor Trip Response, and procedure 2-GOP-2.3, Unit Shutdown. A 4-hour Non-Emergency Report to the Nuclear Regulatory Commission was made at 2104 hours in accordance with 10CFR50.72 due to the Reactor Protection System (RPS) EIIS: JC! actuation. A Non-Emergency Notification to the Virginia Department of Emergency Services was made at 2128 hours.

With the Unit stable at hot shutdown condition, troubleshooting activities were initiated to determine a cause of RPS actuation. The Unit was subsequently brought to the Cold Shutdown condition at 0722 hours on August 30, 1993 to replace the safety injection master relay, continue the investigation and perform additional testing. The original relay was tested in place and picked up and latched with full voltage applied. Therefore, the original relay was fully capable of responding to a safety injection signal. The SIA-B master relay was removed for bench testing. The relay was replaced and the new relay functionally tested. This report is being made pursuant to 10CFR50.73(a)(2)(iv) for a Reactor Protection System actuation.

2.0 SAFETY CONSEQUENCES AND IMPLICATIONS

Following the reactor trip, appropriate operator actions were taken to ensure the performance of RPS automatic actions and to respond to plant conditions. Both reactor trip breakers opened as designed. The control rods fully inserted. The Unit was promptly brought to a stable, safe shutdown condition. The shutdown was orderly and as expected with no significant challenges for the operating team. The shutdown margin of reactivity was calculated and found to be satisfactory. Actual plant conditions did not warrant a RPS actuation. The results of in-place testing conducted on the SIA-B master relay prior to replacement confirmed the relay properly actuated and latched when a SI actuation voltage signal was simulated. This testing determined the relay was fully capable of performing its intended safety function. No significant safety consequences or implications resulted from this event. Therefore the health and safety of the public were not affected.

3.0 CAUSE

The RPS actuation resulted from the SIA-B master relay chattering while the safeguards functional logic testing was underway. The technicians, preparing to check coil resistance on the master relay, witnessed the relay chatter immediately prior to the reactor trip. Bench testing determined that the actuation and reset voltages for the original SIA-B relay were less than that of new relays. The testing also found that the relay would chatter at voltages below the voltage required for the relay to latch. Interviews of the technicians performing the testing indicated no human performance problems caused the relay to chatter. However, voltage checks in the Si logic cabinets could not identify a source voltage to cause the chattering. Therefore, while a human performance issue was not identified, it could not be excluded.

The reactor trip breakers opened as the result of a momentary energization of one of four safety injection slave relays, the SI-1B relay, caused by the master relay chattering. The SI-1B slave relay actuation resulted in de-energizing the reactor trip breaker undervoltage trip coils on both reactor trip breakers opening the breakers. Testing determined that the original master relay contacts, which cause the SI-1 B slave relay to change state, made-up before the other three sets of contacts. The RCE also identified that a chattering SI master relay could cause intermittent energization of the slave relay coils for long enough to cause partial movement of its actuation plunger. Partial movement of the actuation plunger could cause normally closed relays to open, but not necessarily the closure of normally open contacts. The SI-1B slave relay contacts resulting in the reactor trip breakers opening are normally closed contacts. The RCE concluded that the SI slave relay actuations could be explained by the intermittent nature of the signal (the observed chattering) and the time required for the relay to pick up fully.

4.0 IMMEDIATE CORRECTIVE ACTION(S)

Control room operators promptly initiated the appropriate Emergency Operating Procedures and brought the Unit to a stable Hot Shutdown condition. The reactivity shutdown margin was calculated following the RCS cool down to confirm Technical Specification and administrative shutdown margin limits were satisfied. Troubleshooting activities were initiated. Day and night shift investigation teams were organized to determine the cause of the reactor trip. The Shift Technical Advisor, with engineering

support, identified the source of the reactor trip signal as the safety injection master relay. Voltage checks in the SI logic cabinets were satisfactory, and the logic testing was completed. The transient analysis recorder, computer printouts, and safety injection and reactor protection logic diagrams, were used in identifying the source of the reactor trip signal.

The IRPI M-10 rod bottom light has been slow in illuminating. This condition has been observed during previous Unit 2 trips from "at power" conditions. The Nuclear Steam Supply System vendor was recently requested to re-evaluate this condition and confirmed that the condition is an indication problem. The cause of the problem is associated with the permeability (magnetic properties) of either the control rod M-10 pressure housing or its control rod driveline. Following the trip, the indication slowly decreased to indicate full insertion.

5.0 ADDITIONAL CORRECTIVE ACTION

The Unit was placed in the Cold Shutdown condition to continue the investigation, perform additional testing, and replace the safety injection master relay. The results of in-place testing conducted on the original SIA-B master relay confirmed the relay properly actuated and latched when normal SI actuation voltage signals were applied. Safety injection master relay SIA-B was replaced and bench testing was performed on the original safety injection master relay. Results of the bench testing confirmed the relay would latch properly when normal voltage was applied. However, the testing determined that the actuation and reset voltages for the relay were much lower than the voltages for new MG-6 relays tested.

Voltage checks were conducted on the pickup coils on the safety injection train B master relay and no voltages were found. Checks for current leakage paths to the safety injection master relays were performed with no existing leakage found. Safety injection logic test switches were tested and found acceptable. The performance of the reactor trip breakers was evaluated and found satisfactory.

Procedure 2-IPT-FT-RP-SI-001B was reviewed and found acceptable. This procedure, being used by the instrument technicians working in the safety injection logic cabinets at the time of the trip, was reviewed with no procedural problems or inconsistencies identified. A procedural error did not exist or occur. The Instrument Technicians who were performing the testing in the safety injection logic cabinets at the time of the event were interviewed and the interviews were independently observed and reviewed. No human

performance problems were identified.

The maintenance history on the safety injection master relays and the slave relays was reviewed and an NPRDS review was conducted on Westinghouse MG-6 relays. No information on relay chattering was found. Maintenance activities performed on the Reactor Protection System and the Engineered Safety Features during the past refueling outage were reviewed. No related maintenance activities were identified which would have contributed to the event.

Following safety injection master relay SIA-B replacement, safeguards actuation logic functional testing was performed satisfactorily. The testing verified proper SI slave relay operation following master relay energization with SI actuation signals present.

6.0 ACTIONS TO PREVENT RECURRENCE

The specifications for relay functional parameters are being reviewed, including contact clearances and actuation voltages in conjunction with the Cause Determination Evaluation portion of the Root Cause Evaluation. Replacement relays from available stock are being tested as part of the relay parameter specification review. The feasibility of developing relay spring tension testing techniques is being investigated with the relay manufacturer. The development of future preventive maintenance activities is being reviewed for feasibility within the limits of existing design and configuration.

The recommendations of the RCE will be implemented. An RCE recommendation to change I&C procedures to identify temporary steps which can be undertaken to investigate a voltage source in the Train B SI cabinet is being evaluated for implementation methods. The test jacks on the exterior of the SI cabinet and the connections for these test jacks on the inside of the cabinets are being examined to determine if they should be covered.

Engineering is evaluating the RCS cooldowns experienced following reactor trips. Corrective measures identified by the evaluation will be implemented.

7.0 SIMILAR EVENTS

The following Licensee Event Reports for Surry Units 1 and 2 contain Reactor Protection System actuations or Engineered Safety Features actuations caused by relay failures or during testing:

LER S1-93-001: Reactor Trip and Safety Injection due to
Spurious High Consequence Limiting Safeguards
Signal Caused by Malfunctioning Relay.

LER S1-93-002: Reactor Trip during Reactor Protection System
(RPS) Surveillance Testing.

LER S2-89-009: Turbine Trip/Reactor Trip Due to 86 BU Trip
Caused by Spurious Actuation of KD-41 Relay.

LER S1-88-029: Reactor rip/Safety Injection Due to Spurious
High Consequence Limiting Safeguards Signal as a
Result of a Malfunctioning Relay.

TEXT PAGE 6 OF 6

8.0 MANUFACTURER/MODEL NUMBER

Manufacturer: Westinghouse NPRDS: W121!

Type: MG-6
Serial Number: Serial Numbers are not marked on Westinghouse MG-6
relays.

ATTACHMENT 1 TO 9310010127 PAGE 1 OF 1

10CFR50.73

Virginia Electric and Power Company
Surry Power Station
P. O. Box 315
Surry, Virginia 23883

September 27, 1993

U. S. Nuclear Regulatory Commission Serial No.: 93-607
Document Control Desk SPS
Washington, D. C. 20555 Docket No.: 50-281
License No.: DPR-37

Dear Sirs:

Pursuant to Surry Power Station Technical Specifications, Virginia Electric
and Power Company hereby submits the following Licensee Event Report
applicable to Surry Power Station Unit 2.

REPORT NUMBER

50-281/93-005-00

This report has been reviewed by the Station Nuclear Safety and Operating Committee and will be forwarded to the Management Safety Review Committee for its review.

Very truly yours

Mr. R. Kansler
Station Manager

Enclosure

cc: Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

M. W. Branch
NRC Senior Resident Inspector
Surry Power Station

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